

WHAT IS CLAIMED IS:

1. An electron emitter comprising a carbon nanotube particulate on a surface wherein the carbon nanotube particulate comprises entangled small-diameter carbon nanotubes wherein the small-diameter nanotubes have an outer diameter in a range of about 0.5 nm and about 3 nm, wherein the carbon nanotube particulate has a cross-sectional dimension in a range of about 0.1 micron and about 100 microns.
2. The electron emitter of claim 1 wherein the particulate has a cross-section dimension in the range of about 0.1 micron and about 3 microns.
3. The electron emitter of claim 1 wherein the carbon nanotubes are selected from the group consisting of single-walled carbon nanotubes, double-walled carbon nanotubes, triple-walled carbon nanotubes, quadruple-walled carbon nanotubes and combinations thereof.
4. The electron emitter of claim 1 wherein the carbon nanotube particulate comprises ropes of carbon nanotubes.
5. The electron emitter of claim 4 wherein the ropes have a cross-sectional dimension in a range of about 10 nm and about 50 nm.
6. The electron emitter of claim 4 wherein the ropes have a cross-sectional dimension less than 10 nm.
7. The electron emitter of claim 4 wherein the carbon nanotube particulates comprise small-diameter carbon nanotubes having more than about 10 small-diameter carbon nanotubes/ μm^2 surface area of the carbon nanotube particulates.
8. The electron emitter of claim 4 wherein the carbon nanotube particulate on the surface has been activated by etching.
9. The electron emitter of claim 4 wherein the electron emitter is a component in a cathode of a field emission device.

10. The electron emitter of claim 10 wherein the field emission device is selected from the group consisting of electron tubes, amplifiers, oscillators, mixers, microwave components, discharge initiators, laser tubes, spark gaps, controlled discharge tubes, directed energy devices, display tubes, flat-panel displays and combinations thereof.
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11. A method for making a carbon nanotube electron emitter, comprising:
- (a) providing a carbon nanotube particulate wherein the carbon nanotube particulate comprises entangled small-diameter carbon nanotubes, wherein the small-diameter nanotubes have an outer diameter in a range of about 0.5 nm and about 3 nm, wherein the carbon nanotubes are selected from the group consisting of single-walled carbon nanotubes, double-walled carbon nanotubes, triple-walled carbon nanotubes, quadruple-walled carbon nanotubes and combinations thereof, and wherein the carbon nanotube particulate has a cross-sectional dimension in a range of about 0.1 micron and about 100 microns, and
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- (b) depositing the carbon nanotube particulate on a surface.
12. The method of claim 11 wherein the carbon nanotube particulate has a cross-sectional dimension in the range of about 0.1 and about 3 microns.
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13. The method of claim 11 further comprising activating the carbon nanotubes of the carbon nanotube particulate.
14. The method of claim 13 wherein the activating is done by etching means.
15. The method of claim 14 wherein the etching means is selected from the group consisting of chemical etching, electrochemical etching, physical etching and a combination thereof.
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16. The method of claim 14 wherein the etching means comprises chemical etching.

17. The method of claim 16 wherein the chemical etching is done by a method selected from the group consisting of oxidative etching, etching by strong acids, etching by strong bases, and a combination thereof.
- 5 18. The method of claim 14 wherein the etching means is selected from the group consisting of sputtering, reactive ion etching, plasma etching and combinations thereof.
19. The method of claim 11 wherein the carbon nanotube particulate is an annealed carbon nanotube particulate.
- 10 20. The method of claim 19 wherein the annealed carbon nanotube particulate is prepared by heating the carbon nanotube particulate in nitrogen or an inert gas environment at a temperature between about 800°C and 1500°C for a time in the range of about 1 and about 24 hours.
- 15 21. The method of claim 11 wherein a plurality of carbon nanotube particulates is blended with a matrix material selected from the group consisting of thermoplastic polymers, thermoset polymers, metals, ceramics, and combinations thereof.
22. The method of claim 11 wherein a plurality of carbon nanotube particulates are blended with a matrix material comprising a polymer.
- 20 23. The method of claim 11 wherein the depositing of the carbon nanotube particulate on the surface is done by dispersing the particulate in a viscous media to form a carbon nanotube paste and depositing the paste on a surface by a method selected from the group consisting of screen printing, electrophoretic deposition, casting, ink-jet printing, spraying, offset printing, and combinations thereof.